Assignment No. 3

Parallel Computing, DM818 (Fall 2017)

Department of Mathematics and Computer Science
University of Southern Denmark
Daniel Merkle

Exercise 1

Scalability

Assume the following hypothetical overhead function for an algorithm (as usual W denotes the problem size).

$$T_O = p^2 \cdot \sqrt{W} + p \cdot \sqrt{W}$$

Assume that maximal degree of concurrency of the algorithm is $2^{\sqrt{W}}$.

a) Determine the parallel computation time T_P (as a function in W and p).

b) Determine the isoefficiency function due to the overheads T_O.

c) Determine the isoefficiency function due to the maximal concurrency.

d1) Determine the number of processes p', for which the parallel runtime is minimal.

d2) Determine the runtime when using p' processes (cmp. d1).

d3) Determine the asymptotic efficiency (as a function in W) when using p' processes. What is the efficiency for arbitrary large problem sizes W when using p' processes?

Exercise 2

`Prim's minimum spanning tree`

In the parallel formulation of Prim's minimum spanning tree algorithm (Section 10.2), the maximum number of processes that can be used efficiently on a hypercube is $O(n/\log(n))$. By using $O(n/\log(n))$ processes the run time is $O(n\log(n))$.

a) What is the run time if you use $O(n)$ processes?

b) What is the minimum parallel run time that can be obtained on a message-passing parallel computer?

c) How does this time compare with the run time obtained when you use $O(n/log(n))$ processes?